

Blue River Fish Barrier Monitoring



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Summary

Lower Blue River in Greenlee Co., Arizona was visited on October 21 and November 4, 2013 to monitor fishes down- (Reach 1 - San Francisco confluence to barrier) and upstream (Reach 2 - barrier to Pat Mesa) of a fish barrier constructed by Reclamation and completed in June 2012. Fishes were sampled by backpack electroshocker from two fixed sites (one, 200-m site below the barrier and one, 200-m site above the barrier) and two random 200-m sites above the barrier. Nineteen pools > 1m deep were inspected from shore and underwater with mask and snorkel. Gaged stream discharge was approximately 15-20 cfs at the times of our visit, and water was clear. Weather conditions were ideal for both collections and snorkel surveys. Fishes overall were uncommon (> 10 to <100 per site) and catch rates were low. Native longfin dace *Agosia chrysogaster* and speckled dace *Rhinichthys osculus* were captured below the barrier and longfin dace and large, adult native Sonora sucker *Catostomus insignis* plus non-native fathead minnow *Pimephales promelas* and green sunfish *Lepomis cyanellus* were encountered above the barrier. No fish were seen during pool surveys. An adult lowland leopard frog *Lithobates yavapaiensis* was seen; non-native northern crayfish *Orconectes virilis* was not observed.

Introduction

Blue River is a tributary to San Francisco River (Gila River basin) that drains mountain terrains in Apache and Greenlee cos. Arizona, and Catron Co., New Mexico. Nearly the entire watershed is within lands administered by USDA Forest Service on Apache-Sitgreaves and Gila National Forests, but private inholdings are found along certain stream segments. The stream historically was occupied by longfin dace *Agosia chrysogaster*, speckled dace *Rhinichthys osculus*, loach minnow *Tiaroga cobitis*, Sonora sucker *Catostomus insignis*, desert sucker *Pantosteus clarki* (Silvey et al. 1984), and a native trout *Oncorhynchus sp.* (see Minckley 1973, Minckley & Marsh 2009). Razorback sucker *Xyrauchen texanus* historically may have accessed the stream, and tens of thousands were stocked in the late 1980s (Hendrickson 1993) but failed to establish.

Since 1950, non-native brown trout *Salmo trutta*, brook trout *Salvelinus fontinalis*, rainbow trout *Oncorhynchus mykiss*, Apache trout *Oncorhynchus apache*, fathead minnow *Pimephales promelas*, channel catfish *Ictalurus punctatus*, flathead catfish *Pylodictis olivaris*, red shiner *Cyprinella lutrensis*, common carp *Cyprinus carpio*, largemouth bass *Micropterus salmoides*, and western mosquitofish *Gambusia affinis* have been periodically detected within the drainage (Reclamation 2010). A single green sunfish *Lepomis cyanellus* was detected in lower Blue River in late 2011 by Arizona Game and Fish Department (AZGFD), and others were captured during barrier-associated monitoring in autumn 2012 (Marsh et al. 2012) and surveys in summer 2013 (AZGFD in litt.).

To protect native species in Blue River from non-native fishes in the San Francisco River, Reclamation constructed a fish barrier (cover photo) on Blue River approximately 0.8 km upstream from its mouth. The barrier was completed in June 2012. Immediately following closure of the barrier, roundtail chub *Gila robusta* and spinedace *Meda fulgida* were stocked in attempt to establish new populations of these two native fishes.

Reclamation commissioned Marsh & Associates to conduct annual, post-barrier construction fish monitoring of lower Blue River. The primary purpose of this activity is to assess the effectiveness of Reclamation's barrier in preventing upstream invasions of non-native fishes. This is to be accomplished by general monitoring of fish assemblage structure above and below the barrier to document presence of non-native fishes upstream of the barrier, assess effectiveness of mechanical removal of non-native fishes, and determine success or failure of introductions of new native species. This report provides results of second monitoring event, which was conducted in autumn 2013; Marsh et al. 2012 summarize the first year of monitoring.

Methods

The constructed fish barrier on lower Blue River (Figure 1) is located near UTM 668124E 367503E (NAD83) and is accessed from downstream by vehicle via Martinez Ranch Road to a primitive road along the San Francisco River to Blue River (obliterated by flooding in mid-September 2013), from upstream by 12 km hike down river from Juan Miller Crossing (Forest Service Road 475), or via helicopter. The portion of Blue River to be monitored included two segments: Reach 1 from San Francisco River to the fish barrier, and Reach 2 from the fish barrier upstream to Pat Mesa (Figure 1). Reach 2 was further subdivided into 23, 200-m long sub-reaches, consecutively numbered 1-23, upstream from the fish barrier. We visited the area on October 21 and November 4, 2013 and followed most protocols and procedures described by Clarkson et al. (2011); we followed AZGFD (2012) with respect to site lengths (200-m) and fish measurements.

Two fixed sites, one below and one above the barrier were established during a preliminary reconnaissance and inspection on October 4 & 5, 2012; UTM coordinates are in Table 1. The below barrier site was 200-m long and its downstream boundary was approximately 550 m downstream from the barrier and 250 m upstream from the San Francisco confluence. The above barrier site was 200-m long and its downstream boundary was approximately 2800 m upstream from the barrier in sub-reach 15.

Two, randomly-selected 200-m monitoring sites were established in Reach 2 prior to departure for the field; these were located in sub-reaches 17 and 19, respectively beginning 3200 and 3600 m upstream from the barrier (Table 1).

All sites were measured along the thalweg using a standard hip chain, and up- and downstream boundaries plus transitions between mesohabitat types (pool, riffle, and run) were noted. Photographs at the two fixed sites were taken with views up- and downstream from the up- and downstream boundaries (total of four photos per site).

Fishes were captured from individual mesohabitats using a Smith-Root type 24-A backpack electrofisher (nominal settings I-5, 200 VDC; approximately 0.4-0.5 output amps) and species identity and number plus effort (shocking seconds real-time) were recorded into field notebooks and later transferred to standard data forms. The following procedure for measuring and processing captured fishes (AZGFD 2012, and project Statement of Work) was in place and followed in-part: all spikedace, loach minnow, and roundtail chub captured at each processing point will be measured for total length (TL, mm) until the number measured exceeds 100; thereafter fishes will be enumerated only. All large-bodied fishes (e.g., suckers, roundtail chub, or non-native piscivores) captured will be enumerated and similarly measured for TL; those species observed by snorkeling (see below) but not captured will be categorized by general size category: ≤ 50 , 51-100 and >100 mm. Fishes captured during surveys on this trip were only categorized by size group. Native fishes will be released alive downstream from the processing site and non-native fishes will be dispatched and buried. Individual mortalities of threatened or endangered species, if any, will be fixed, preserved, labeled, and submitted for accession into the Arizona State University Collection of Fishes, Tempe, in accordance with State and Federal permits. On this trip, only green sunfish captured above the barrier was measured.

All pools within Reach 2 greater than about a meter deep were inspected by a diver from the bank and underwater using mask and snorkel. Pool location (UTM), fishes encountered, size category, disposition of fishes, and general comments were recorded.

Field data books were checked for completeness and any errors corrected prior to departing the site. Data were later transferred to standard data sheets and entered into Reclamations' Access[®]-based electronic database, and all entries were verified.

Results

We visited lower Blue River below the barrier on October 21, 2013 (via Martinez Ranch) and above the barrier on November 4, 2013 (via Juan Miller crossing). Discharge at times of our visits was approximately 20-15 cfs at the Juan Miller gage upstream of our study area (Figure 2). The stream channel immediately above the barrier was shallow and relatively wide (cover photo taken October 21, 2013), but there was no deep reservoir-pool, and immediately downstream of the barrier apron the stream was similar. Habitat down- and upstream was shallow riffles and relatively few deep pools, and substrates were largely clean and loose with few fines. There was little evidence of ash derived from the Wallow Fire in the upper watershed in summer 2011, and which blanketed substrates the previous autumn (Marsh et al. 2012). Weather was clear and cool, and water clarity was high, so conditions were ideal for stream sampling and visual inspection of pools. Debris high on canyon walls (e.g., Figure 3) was evidence of flooding that exceeded 10,000 cfs on September 15, 2013 (USGS 2013), and likely cleaned and sorted substrates throughout the stream.

Fixed sites. The 200-m below barrier fixed site was comprised of six mesohabitats: two pools, two riffles, and two runs. Pools were up to 2 m deep and bottoms were sand, organic debris, and bedrock, with fines only in eddies. Riffle substrates were mostly loose cobbles and gravel with one area of coarse organic debris, and bottom materials in runs were mixtures of sand, gravel, and cobble. Fish were uncommon and 17 individuals among two species, native longfin dace and speckled dace, were taken in 787 seconds of electrofishing (Table 2). A single adult lowland leopard frog *Lithobates yavapaiensis* was observed.

The 200-m above barrier fixed site was comprised of six mesohabitats: two pools (both attached, adjacent backwaters), two riffles, and two runs. Pools were of variable depth to 1 m, with bottoms of silt or sand, cobble, and bedrock. Riffle substrates were mostly loose gravel and cobble, and runs were gravel-cobble or gravel-sand. Fish were uncommon and comprised of two native species, longfin dace and Sonora sucker (large, age-1+ fish), and one non-native, fathead minnow; 62 total individuals were taken in 722 sec of electrofishing (Table 2).

Random sites. The 200-m sub-reach 17 (lower) random site was comprised of five mesohabitats: two riffles alternating with three runs. Riffles had bottoms of mostly loose cobble or gravel-cobble and runs were sandy-gravel or sand-gravel and bedrock. Fishes were uncommon and 75 individuals representing four species, native longfin dace and Sonora sucker (large, age-1+), and non-native fathead minnow and green sunfish (age-1+, ca. 90 mm TL) were captured in 948 sec electrofishing (Table 3).

The 200-m sub-reach 19 (upper) random site was comprised of three mesohabitats: one each pool, riffle, and run. The shallow pool substrate was sand and sparse fines, riffle substrate was mostly loose gravel and cobble, and the run was sand and gravel. Fishes were uncommon and 26 individuals representing two species, native longfin dace and non-native fathead minnow, were captured in 572 sec of electrofishing (Table 3).

Pool sampling. There were 19 pools within Reach 2 that were greater than about a meter in depth and available for examination using mask and snorkel (Table 4). Water was clear and visibility good-to-excellent. Each pool was thoroughly examined visually from the bank for fishes prior to entering the water, but none was seen, and all were confirmed as fishless after careful underwater observation (Table 4).

Miscellaneous observations. Longfin dace nests were rare and restricted to a few depressions in the downstream portion of the upper random (reach 19) site. Non-native northern crayfish *Orconectes virilis* was not seen.

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Table 1. Fish monitoring station boundaries (UTMs, NAD83, Zone 12 S), Blue River, Greenlee Co., Arizona, October 21 and November 4, 2013. Sub-reach designations are m/200 upstream of the fish barrier; meters upstream from the fish barrier in parentheses.

Location	Type	Sub-reach (m)	Lower boundary	Upper boundary
Below barrier	Fixed	---	668272E 3676054N	668177E 3676076N
Above barrier	Fixed	15 (2800)	668392E 3678112N	668473E 3678234N
Above barrier	Random	17 (3200)	668422E 3678108N	668480E 3678250N
Above barrier	Random	19 (3600)	668569E 3678418N	668496E 3678570N

Table 2. Results of fish monitoring within two, fixed sites, one below and one above the constructed fish barrier on Blue River, Greenlee Co., Arizona, October 21 (below barrier) and November 4 (above barrier), 2013. The below barrier site is 200-m in length and its downstream boundary is approximately 550 m downstream of the barrier; the above barrier site is 200-m long and its down-stream boundary is approximately 2800 m upstream of the barrier (sub-reach 15). Effort is seconds real-time electrofishing, and CPE is number of fish per unit effort. Native species are indicated by an asterisk (*).

Downstream (below barrier) fixed site; effort = 787 sec

Species	Catch	Proportion	CPE
Longfin dace*	11	0.65	0.014
Speckled dace*	6	0.35	0.008
Totals	17	1.00	0.022

Upstream (above barrier) fixed site; effort = 722 sec

Species	Catch	Proportion	CPE
Longfin dace*	60	0.97	0.083
Fathead minnow	1	0.16	0.001
Sonora sucker* (large, age 1+)	1	0.16	0.001
Totals	62	1.00	0.086

Table 3. Results of fish monitoring within two, random sites above the constructed fish barrier on Blue River, Greenlee Co., Arizona, November 4, 2013. Downstream boundaries of sites were 3200 (sub-reach 17) and 3600 m (sub-reach 19) upstream of the barrier; each site was 200-m long. Effort is seconds real-time electrofishing, and CPE is number of fish per unit effort. Native species are indicated by an asterisk (*).

Above Barrier, lower Random Site – Sub-reach 17; effort = 948 sec

Species	Catch	Proportion	CPE
Longfin dace*	67	0.89	0.071
Fathead minnow	5	0.07	0.005
Sonora sucker* (large, age 1+)	2	0.03	0.002
Green sunfish	1	0.01	0.001
Totals	75	1.00	0.079

Above Barrier, upper Random Site – Sub-reach 19; effort = 572 sec

Species	Catch	Proportion	CPE
Longfin dace*	22	0.85	0.038
Fathead minnow	4	0.15	0.007
Totals	26	1.00	0.045

Table 4. Location (UTMs, NAD83, Zone 12 S) of 19 pools and results of snorkel surveys, Blue River, Greenlee Co., Arizona, October 21 (pools 1-11) and November 4 (pools 12-19), 2013. Pools numbers are down- to upstream above the constructed fish barrier.

Pool No.	Location		Survey Result
1	668203 E	3676768 N	fishless
2	668120 E	3676854 N	fishless
3	667764 E	3677270 N	fishless
4	667669 E	3677315 N	fishless
5	667515 E	3677318 N	fishless
6	667497 E	3677651 N	fishless
7	667478 E	3677705 N	fishless
8	667530 E	3677832 N	fishless
9	667607 E	3678012 N	fishless
10	668002 E	3678271 N	fishless
11	668089 E	3678440 N	fishless
12	668160 E	3678436 N	fishless
13	668182 E	3678293 N	fishless
14	668436 E	3678106 N	fishless
15	668469 E	3678137 N	fishless
16	668563 E	3678322 N	fishless
17	668552 E	3678520 N	fishless
18	668289 E	3678659 N	fishless
19	668210 E	3679110 N	fishless

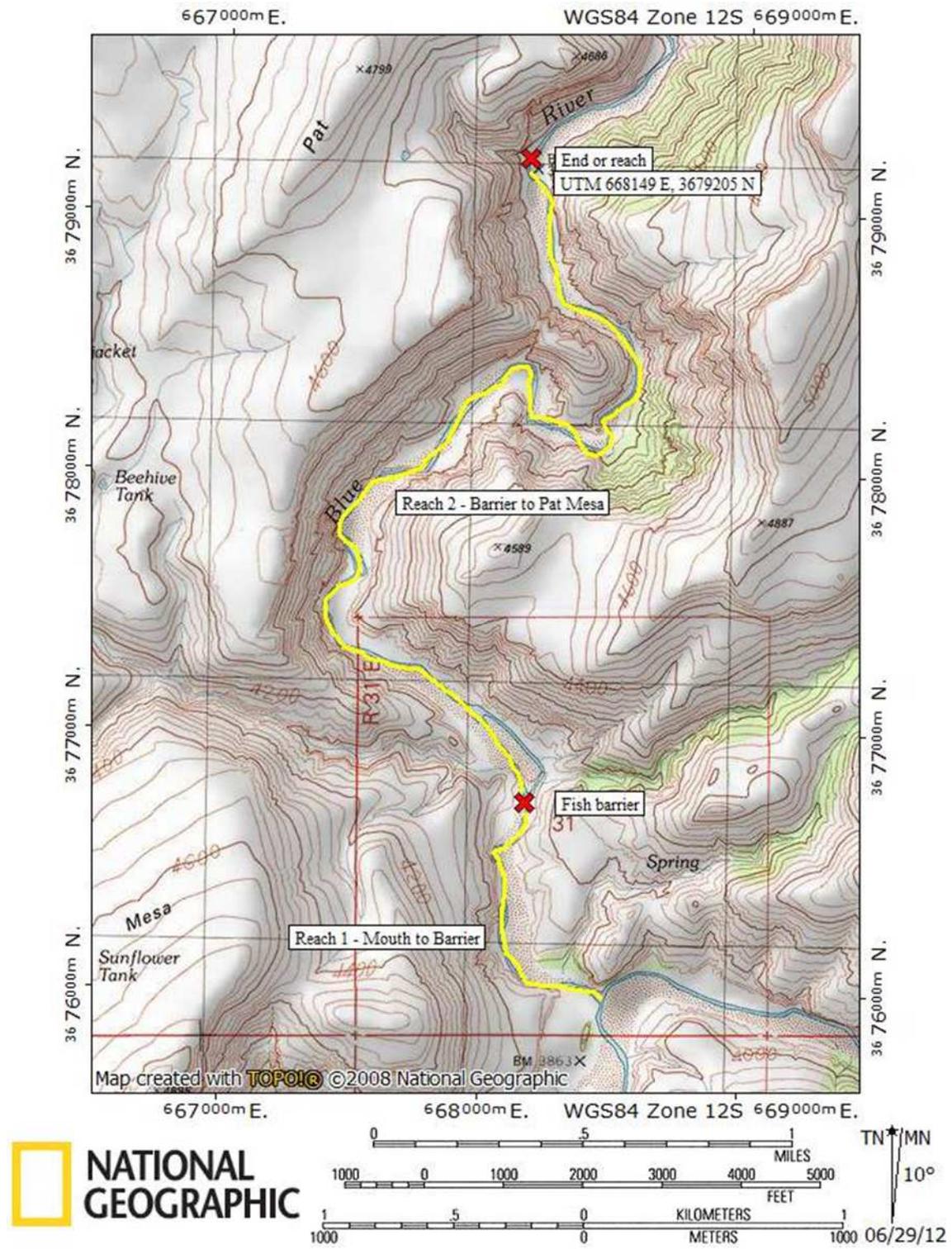


Figure 1. Map of lower Blue River, Greenlee County, Arizona, showing location of fish barrier and sampling Reaches 1 & 2. Map locations provided by Reclamation.

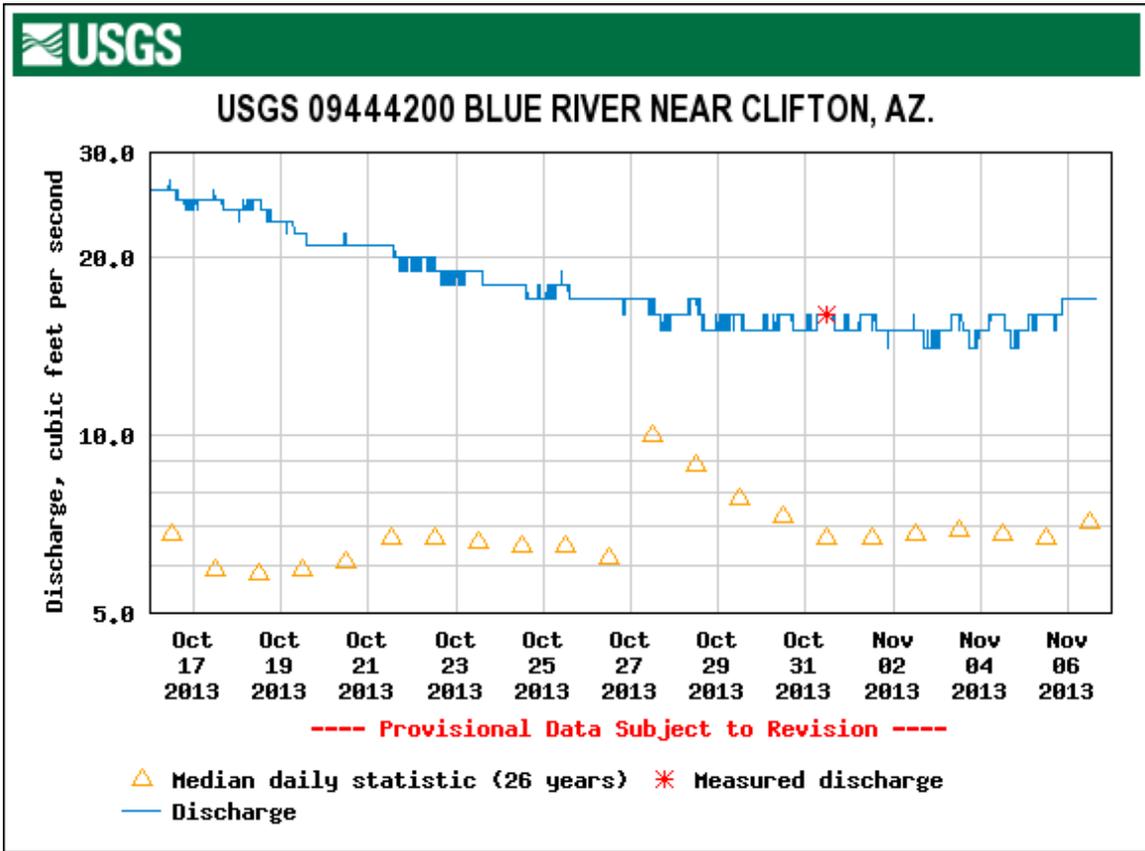


Figure 2. Discharge in Blue River, Greenlee Co., Arizona during and prior to the period of fish monitoring October 21 and November 5, 2013. The gauge site is at Juan Miller crossing (Forest Service Road 475) about 12 km upstream of the barrier.



Figure 3. Blue River, Greenlee Co., Arizona, showing debris deposited about 3 m above the stream channel presumably during flooding on September 15, 2013. The location is at the USGS stream gauge site at Juan Miller crossing (Forest Service Road 475) about 12 km upstream of the barrier. Photo by RWC taken November 4, 2013.